

**WHAT IS CLAIMED IS:**

1. A cholesteric liquid crystal display for producing gray scale images, comprising:

a) a layer including a polymeric host material, cholesteric liquid crystals in the host material and having a selected domain size, and a surfactant, the materials in the layer selected to cause the cholesteric liquid crystals to be effective in a number of different states of reflectivity and will remain in any given state until a field is applied;

b) electrodes disposed relative to the layer for applying an electric field to the layer when a voltage is applied to the electrodes; and

c) means for applying at least one voltage pulse to the electrodes which cause the direct change of the cholesteric liquid crystals from any initial state to a particular state within a selected gray scale.

2. A cholesteric liquid crystal display for producing gray scale images, comprising:

a) a layer including a polymeric host material, cholesteric liquid crystals in the host material and having a selected domain size in a range of 4 to 20 microns, the layer having a dry thickness less than 15 microns, and a surfactant, the cholesteric liquid crystals being effective in a number of different states of reflectivity and will remain in any given state until a field is applied;

b) electrodes disposed relative to the layer for applying an electric field to the layer when a voltage is applied to the electrodes; and

c) means for applying a series of voltage pulses to the electrodes which cause the direct change of the cholesteric liquid crystals from any initial state to a particular state within a selected gray scale.

3. A cholesteric liquid crystal display for producing gray scale images, comprising:

a) a layer including a polymeric host material, cholesteric liquid crystals in the host material and having a domain size selected to be in a range of 4 to 20 microns, the layer having a dry thickness less than 15 microns, and a surfactant, the cholesteric liquid crystals being effective in a number of different states of reflectivity and will remain in any given state until a field is applied;

b) electrodes disposed relative to the layer for applying an electric field to the layer when a voltage is applied to the electrodes; and

c) means for applying a series of voltage pulses to the electrodes having a predetermined duty cycle, frequency and number of pulses and amplitude, the amplitude being selected that will cause the cholesteric liquid crystals to be in a particular state within a selected gray scale irrespective of the initial state of the cholesteric liquid crystals.

4. A cholesteric liquid crystal display for producing gray scale images, comprising:

a) a layer including a polymeric host material, cholesteric liquid crystals in the host material and having a domain size selected to be in a range of 4 to 20 microns, the layer having a dry thickness less than 15 microns, and a surfactant, the cholesteric liquid crystals being effective in a number of different states of reflectivity and will remain in any given state until a field is applied;

b) electrodes disposed relative to the layer in rows and columns so that the intersection of a row and column defines pixels for applying an electric field at each intersection to the layer when a voltage is applied to the electrodes; and

c) means for applying a series of voltage pulses to the rows and columns of the electrodes which cause the direct change of the cholesteric liquid crystals in the pixels from any initial state to a particular state within a selected gray scale.

5. A cholesteric liquid crystal display for producing gray scale images, comprising:

a) a layer including a polymeric host material, cholesteric liquid crystals in the host material and having a selected domain size, and a surfactant, the materials in the layer selected to cause the cholesteric liquid crystals to be effective in a number of different states of reflectivity and will remain in any given state until a field is applied the cholesteric liquid crystals wherein for a given set of drive signals, the cholesteric material changing to a state between the focal conic and planar states irrespective of the initial state of the material;

b) electrodes disposed relative to the layer for applying an electric field to the layer when a voltage is applied to the electrodes; and

c) means for applying the drive signals in the form of voltage pulses to the electrodes which cause the direct change of the cholesteric liquid crystals from any initial state to a particular state within a selected gray scale.

6. A color display having a plurality of displays in accordance with claim 1 with the cholesteric liquid crystals in the different displays producing a different color to thereby produce a multicolored image.